Abstract

Speciation of trace metals has been studied on two different aquatic systems belonging to the watershed of the Scheldt estuary influenced either by past metallurgical activities or by urban effluents.

The first study area was the Deûle River situated in Northern France close to the smelter Metaleurop which has been closed in 2003. To better understand the dynamic variations of metals in the water column where sediments are highly polluted and frequently resuspended due to intense fluvial traffic, a monitoring campaign has been performed on Metaleurop area in April-May 2009 to register at high frequency physico-chemical parameters (such as pH, turbidity, temperature) and metal concentrations in the SPM (Suspended Particle Matter) and in the dissolved phase as well. Intensity of sediment resuspension events and biological activity appear to be the main factors controlling metal variations in suspended particulate material. An automatic trace metal monitoring system (ATMS) using a solid amalgam working electrode has also been deployed to measure every 2 hours over 3 weeks labile zinc concentrations by voltammetry. Dial cycles have been highlighted and are dependent on phytoplankton activity, resuspension of polluted sediment and temperature variations. Due to the presence of metals at different concentrations, a voltammetric procedure using a hanging mercury drop electrode has been successfully developed and validated to measure labile Cu, Pb and Zn in this river. Finally, from monitoring data, a model has been developed to reconstruct partition coefficient of Cu and Cd in surface waters.

The second study area was the Zenne River in Brussels (Belgium) which is a small urban river strongly impacted by human activities. Existing metal data at low-frequency (monthly sampling) and new metal data collected at high-frequency (from 30 mn to 1h30 sampling) during dry and rain conditions have been compared to highlight the importance of studying short-time dynamics to catch the whole variability of the river system. The intense rainfall event of June 16th 2011 was deeper studied to understand its effect on metal variations in dissolved and particulate phases. Finally, complexation of Zn was seasonally assessed using HR-ICP-MS for total dissolved concentration and voltammetry for labile fraction. Results show that natural metal complexing organic ligands dominate metal speciation and that obtained values for complexation parameters are dependent on several factors such as the technique used, the sampling location or the season.